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Indian Standard

SPECIFICATION FOR GREY CAST IRON INGOT MOULDS, STOOLS AND SLAG LADDLES

PART III GREY CAST IRON INGOT MOULDS OF MASS MORE THAN ONE TONNE AND UP TO EIGHT TONNES

(First Revision)

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PART III GREY CAST IRON INGOT MOULDS OF MASS MORE THAN ONE TONNE AND UP TO EIGHT TONNES

(First Revision)

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Indian Standard

SPECIFICATION FOR GREY CAST IRON INGOT MOULDS, STOOLS AND SLAG LADDLES

PART III GREY CAST IRON INGOT MOULDS OF MASS MORE THAN ONE TONNE AND UP TO EIGHT TONNES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 September 1982, after the draft finalized by the Cast Iron & Malleable Cast Iron Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1964. While reviewing this standard in the light of the fact that during recent years production of ingot steel has gone up many folds and various sizes of ingot moulds are being used, the Committee felt that this standard should be split up into following parts:

- i) Part I Bottom stools for large size ingot moulds weighing eight tonnes and higher
- ii) Part II Grey cast iron ingot moulds of mass more than eight tonnes
- iii) Part III Grey cast iron ingot moulds of mass more than one tonne and up to eight tonnes
- iv) Part IV Grey cast iron ingot moulds of mass up to one tonne
  - a) Without hot tops, and
  - b) With hot tops

0.2.1 This standard is one of the series of the above parts and shall be covering ingot moulds of mass more than one tonne and up to eight tonnes.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements for grey cast iron ingot moulds of mass from 1·0 tonne to 8·0 tonnes.

2. GRADES

2.1 Grey iron ingot moulds shall be of one grade only.

3. SUPPLY OF MATERIALS

3.1 General requirement relating to supply of grey cast iron ingot moulds shall conform to IS : 1387-1967†.

4. MANUFACTURE

4.1 The melting procedure shall be optional to manufacturer.

5. CHEMICAL COMPOSITION

5.1 The material, when analysed in accordance with IS : 228-1959‡, shall conform to the requirements specified in Table 1.

TABLE 1 CHEMICAL COMPOSITION OF GREY IRON INGOT MOULDS

CONSTITUENT	PERCENT
Carbon *equivalent*: (Total carbon + 0·3 Si + P)	4·0 to 4·5
Total carbon	3·40 to 3·6
Combined carbon	0·10 to 0·30
Silicon	1·4 to 1·8
Manganese	0·50 to 0·90
Sulphur, *Max*	0·08
Phosphorus, *Max*	0·30

6. POURING METHOD

6.1 Pouring shall be done from the ladle with the help of stopper rod. Alternatively, it may be from the lip poured ladle, with sufficient care to avoid flow of slag into the casting. In either case, flow of hot metal shall

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*Rules for rounding off numerical values (*revised*).

†General requirements for the supply of metallurgical materials (*first revision*).

‡Methods of chemical analysis of pig iron, cast iron and plain carbon low alloy steels (*revised*).

be continuous with the hot metal level in the pouring cup not less than half its height. After pouring is over, sufficient feeding shall be given to avoid shrinkage.

7. POURING TEMPERATURE

7.1 Pouring temperature shall be 1 240 to 1 280°C measured with an immersion or optical pyrometer. When optical pyrometer is used, necessary correction to the reading, if required shall be applied.

8. COOLING CYCLES

8.1 Moulds shall be stripped off only after 4 hours after pouring to ensure complete solidification of the metal in the mould. After this the ingot mould shall be kept in sand jackets for uniform cooling to ensure minimum thermal stress. Cooling in the sand jackets shall not be less than 20 hours for up to 4 T ingot moulds and 50 hours for higher weight moulds. Premature washing of the sand with water jet shall not be allowed.

9. DIMENSIONS

9.1 The purchaser shall design the ingot mould taking the following factors into consideration.

i) Capacity of their melting unit, ladle capacity, etc,

ii) Capacity or design of their processing units like rolling mill or forge shops, etc,

iii) Size and shape of the end products,

iv) Different operating practices,

v) Various metallurgical considerations,

vi) Any other factors deemed fit for consideration.

9.2 The castings shall conform to the dimensions of the drawings furnished by the purchaser. If the manufacturer apprehends any genuine difficulty with any dimension/design aspect, the same will be sorted out with the purchaser before undertaking the actual manufacture.

10. PREPARATION OF MOULDS

10.1 Ingot moulds should be cast in sand mould. The sand moulds should have a graphite coating and green hardness 80 to 90 and bottom hardness 88 *Min*. Dry strength of the sand mixture should be more than 0·65 MPa and permeability more than 200. The sand moulds should be sufficiently dried before assembling. Sufficient vents should be provided.

11. FREEDOM FROM DEFECTS

11.1 It is desirable to have structure of the cast iron pearlitic-ferritic, with flaked graphite and without presence of free cementite.

11.2 Inside surface of ingot moulds shall be cleaned of moulding sand, free from any seams, sand depression, projections, cracks, crust, cavities, cold shut, scruff marks pittings, scabs, rat-tail and other similar defects.

12. RECTIFICATION

12.1 Removal of inside defects, it may be achieved by smooth grinding without creating depressions or undulations or cracks etc, shall be permitted, subject to the prior approval of the purchaser.

12.2 No rectification of inside defects or cavities by welding shall be permitted. However, if purchaser and manufacturer mutually agree, they may decide on certain terms of weld rectification of inside defects.

13. DEFECTS ON OUTSIDE SURFACE

13.1 It is desirable that outside surface of ingot moulds shall not have any cracks, cavities, projections, and shall be clean from burnt moulding sand and fins.

13.2 However, when defects do occur on the outside surface of the ingot moulds the purchaser and the manufacturer will decide jointly whether the moulds can be accepted without rectification or with rectification at all or they are to be rejected.

14. MACHINING OF TOP/BOTTOM FACE

14.1 The bottom face of the open ingot moulds shall be so cast as to make it perpendicular to the axis of ingot mould. Machining of bottom face may be done if agreed to between the purchaser and the manufacturer.

14.2 In the case of plug bottom moulds machining is not required; but the bottom face should be reasonably flat and perpendicular to the mould axis in the as cast condition. (Maximum permissible undulation: ± 2 mm).

14.3 The top surface of the ingot mould shall be machined, if required by the purchaser.

15. PERMISSIBLE DEVIATION IN INGOT MOULD DIMENSIONS

15.1 Permissible deviation in the Ingot Mould dimensions from the drawing dimensions shall be generally as specified in Table 2. Deviations more than specified may be accommodated by mutual agreement between the purchaser and the manufacturer.

TABLE 2 PERMISSIBLE DEVIATION IN INGOT MOULD DIMENSIONS

(*Clause* 15.1)

SL No.	DESCRIPTION OF DEVIATION	DEVIATION, mm	NOTE
i)	Height deviation	± 25	Without disturbing the inside contour
ii)	Difference in wall thickness	± 5	
iii)	Difference, diagonal of inside cross-section	± 6	
iv)	Dimensions of inside cross-section	± 4	
v)	Angular curvature radius	± 3	
vi)	Lug dimensions	± 5	In any direction
vii)	Lug displacement	± 5	In any direction
viii)	Difference of wall thickness of flutes as per depth	± 5	Without affecting the inside contour
ix)	Outer dimensions of bottom end	$^{+20}_{-5}$	

16. RECOMMENDATIONS FOR USE OF INGOT MOULD

16.1 Recommended standard practices for using ingot mould for better performance are given in Appendix A.

17. SAMPLING FOR CHEMICAL ANALYSIS

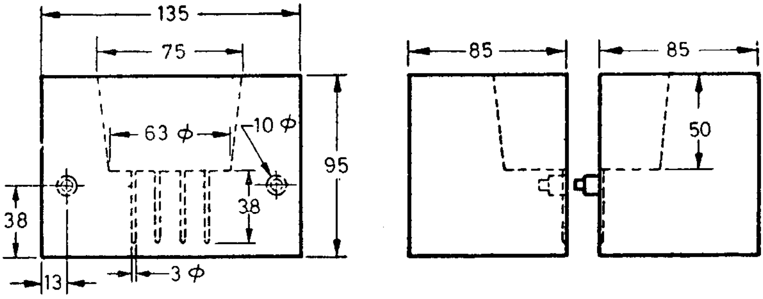
17.1 Two spoon samples shall be taken during the pouring of each cast or ladle when about one-third and two-thirds of the metal has been discharged. The spoon samples so obtained shall be cast separately in dry sand in the form of 30 mm diameter bars about 75 mm long. Alternatively the mould may be filled directly from the metal stream. The test bars shall be suitably marked so that the castings they represent could be identified.

17.2 After cleaning the surface, two flats shall be ground near the bottom of each test bar and the test bar drilled with a 25 mm drill from one clean surface to the other. The speed of the drill should not be more than 9 to 10 rev/min. Drillings after being thoroughly mixed shall constitute the sample for chemical anylsis.

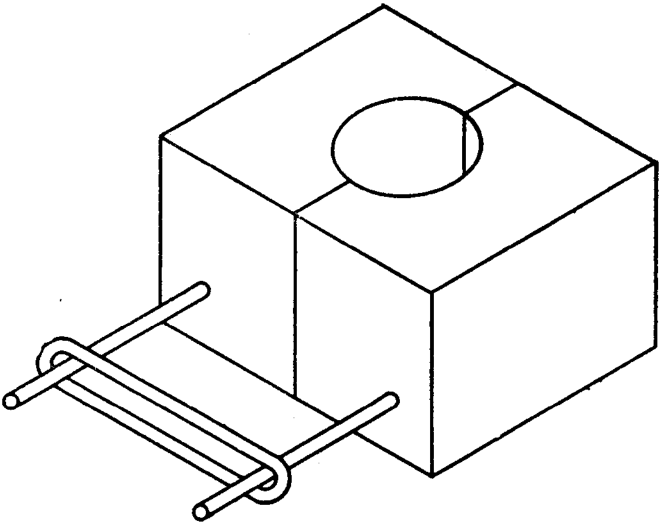
17.3 For the determination of total carbon the liquid metal shall be poured into a special split mould (*see* Fig. 1). This gives pins of iron 3 mm in diameter which can be broken off and used directly for total carbon determination.

18. RE-TEST AND REJECTION

18.1 If a sample selected for testing fails to meet the requirements specified under **5.1**, the purchaser shall select two further samples from the same cast or ladle. If on testing, either of these samples fails to meet the specified requirements, the whole lot shall be deemed as not complying with this standard.



FRONT AND SIDE ELEVATIONS



All dimensions in millimetres.

FIG. 1 PIN MOULD FOR CARBON SAMPLES

19. MARKING

19.1 Each ingot mould shall be legibly marked with cast mould serial number and manufacturer's initials or trade-mark so that it is possible to trace the cast or ladle from which it was poured.

19.2 The material may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(*Clause* 16.1)

RECOMMENDED STANDARD PRACTICES IN USING INGOT MOULDS FOR BETTER PERFORMANCE

A-1. Every new mould shall be thoroughly preheated to a temperature of 100-150°C before it is put in service.

A-2. Mould temperature before teeming shall be maintained within the range of 60-90°C. Mould shall not be used in either overheated or cold condition.

A-3. Moulds shall invariably be cleaned and coated before teeming.

A-4. Temperature of metal during teeming shall not exceed 1 570°C.

A-5. Running stopper, inclined stream and cold heat shall be avoided as far as possible.

A-6. Ingot residence time shall be effectively controlled to a minimum.

A-7. Artificial cooling shall not be resorted to until the mould temperature comes down to 300°C, which may take 3 to 4 hours time. Mould cycle shall be preferably kept at 16 hours.

INDIAN STANDARDS ON CAST IRON AND MALLEABLE CAST IRON

IS :	
210-1978	Grey iron castings (*third revision*)
1230-1978	Cast iron rainwater pipes and fittings (*second revision*)
1536-1976	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage (*second revision*)
1537-1976	Vertically cast iron pressure pipes for water, gas and sewage (*first revision*)
1538 (Parts I to XXIII)-1976	Cast iron fittings for pressure pipes for water, gas and sewage (*second revision*)
1729-1964	Sand cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories
1865-1974	Iron castings with spheroidal or nodular graphite (*second revision*)
1879 (Parts I to X)-1975	Malleable cast iron pipe fittings (*first revision*)
2107-1977	Whiteheart malleable iron castings (*first revision*)
2108-1977	Blackheart malleable iron castings (*first revision*)
2640-1977	Pearlitic malleable iron castings (*first revision*)
2749-1974	Austenitic iron castings (*first revision*)
3005-1964	Grey cast iron ingot moulds, stools and slag ladles
3355-1974	Grey iron castings for elevated temperatures for non-pressure containing parts (*first revision*)
3486-1966	Cast iron spigot and socket drain pipes
3516-1966	Cast iron pipe flanges and flanged fittings, Class 9, for petroleum industry
3896-1966	Comparison of Indian and overseas standards for iron castings
3989-1970	Centrifugally-cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (*first revision*)
4771-1972	Abrasion-resistant iron castings (*first revision*)
5519-1969	Deviations for untoleranced dimensions of grey iron castings
5531 (Parts I to III)-1977	Cast iron specials for asbestos cement pressure pipes (*first revision*)
5787-1970	Spheroidal or nodular graphite iron castings for paper mill dryer rolls
5788-1970	Iron castings with spheroidal or nodular graphite for pressure-containing parts for use at elevated temperatures
5789-1970	Austenitic spheroidal iron castings for pressure containing parts suitable for low temperature service
6163-1978	Centrifugally cast (spun) iron low pressure pipes for water, gas and sewage (*first revision*)
6331-1971	Automotive grey iron castings
6418-1971	Cast iron and malleable cast iron flanges for general engineering purposes
6629-1972	Cast iron rolls
7181-1974	Horizontally cast iron double flanged pipes for water, gas and sewage
7520-1974	Corrosion-resistant high silicon iron castings
7925-1976	Low alloy types of abrasion resistant iron castings
8329-1977	Centrifugally cast (spun) ductile iron pressure pipes for water, gas and sewage
8349-1977	Deviations for untoleranced dimensions of malleable iron castings
8350-1977	Deviations for untoleranced dimensions of spheroidal or nodular graphite iron castings
8794-1978	Cast iron detachable joints for use with asbestos cement pressure pipes
9523-1980	Ductile iron fillings for pressure pipes for water, gas and sewage

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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